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ELECTRIC SYSTEM REVIEW AND EVALUATION

REA BULLETIN 161-5

OCTOBER 1978

"No further funds may be advanced under this program unless this report is completed and filed as required"

Form OM 40-R2350

USDA — REA

REVIEW RATING SUMMARY

Ratings on form are: 0: No records 1: Corrective actions are needed 3: Satisfactory
2: No action required, but might be improved

PART I. TRANSMISSION

1. Transmission Substations (Rating)

a. Safety, Clearance, Code Compliance

b. Physical Condition: Structure, Major Equipment, Appearance

c. Inspection Records Each Substation (Bulletin 165-1)

PART II. DISTRIBUTION

2. Distribution Substations (Rating)

a. Safety, Clearance, Code Compliance

b. Physical Condition: Structure, Major Equipment, Appearance

c. Inspection Records Each Substation (Bulletin 165-1)

3. Distribution Lines - Overhead

a. Inspection and Maintenance: Program and Records (Bulletin 161-3)

b. Clearance with Safety Codes: Clearances

c. Foreign Structures

d. Attachments

e. Field Checking

f. Safety

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UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Electrification Administration

October 25, 1978

REVISION OF REA BULLETIN 161-5

SUBJECT: Electric System Review and Evaluation

This bulletin has been revised to eliminate a number of forms and detailed data from the periodic electric system review required by REA. REA Form 300 has been simplified to emphasize systematic records which should be parts of continuing procedures for operation, maintenance and planning. Forms 301, 302, 303, and 304 have been eliminated but some material from Form 303 is now included in the revised Form 300.

The review procedure outlined in this bulletin is initiated periodically by the REA field engineer who will also evaluate the results of the review. His statement concerning the condition of the system is required as a part of the REA loan procedure. However, the review itself should be completed by management and other key employees of the distribution system. Operation, maintenance and planning should be continuing activities in accordance with the needs of the electric system.

This revised bulletin is intended to assist in identifying needs and setting priorities. We welcome your cooperation and any further ideas for improvement.

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ENCLOSURE
REA Form 300, Review Rating Summary

UNITED STATES DEPARTMENT OF AGRICULTURE
Rural Electrification Administration

October 25, 1978
Supersedes 12/17/71

REA BULLETIN 161-5

SUBJECT: Electric System Review and Evaluation

- I. Purpose: To provide criteria and procedures for REA electric distribution borrowers to use in reviewing the effectiveness of their programs for electric system operation and maintenance and plans for the future, and to provide for the evaluation of such programs and plans by REA.
- II. Objectives of the Review and Evaluation: The aim of the electric system review is to assure that timely actions are being taken for safe and effective operation and to identify items in need of attention. For REA and the investment community, this review and evaluation gives assurance that resources are being responsibly used, that borrowers are operating and maintaining their systems adequately, and that future needs are being anticipated. Specific objectives are:
 - A. Identify items that may be in need of additional attention (effort over and above existing procedures and scheduled work).
 - B. Plan corrective actions when needed, and a time schedule for implementation.
 - C. Budget funds and manpower for the needed work.
 - D. Initiate on-going programs as necessary to avoid or minimize the need for "catch-up" programs in the future.
- III. Responsibility:
 - A. Each borrower is responsible for its work plans, for on-going operation and maintenance programs, for records of the physical and electrical condition of its system and for the quality of service provided to consumers.
 - B. The REA field engineer is responsible, within his assigned territory, for initiating a periodic review and for making an evaluation of each borrower's electric system. This review and evaluation should be done at least once every three years.

IV. REA Guidelines: The borrower is expected to follow practices described in REA bulletins or other equivalent practices. The field engineer may accept alternative forms and procedures which satisfy the needs of REA. The guidelines and records most often referred to during a review and evaluation are those in the following bulletins:

- 40-4 Guide for Mapping and Location Numbering of Electric Distribution Systems
- 60-10 Construction Work Plans, Electric Distribution Systems
- 105-1 Annual Work Programs and Budgets for Rural Electric Distribution Systems
- 105-7 Long Range System and Financial Planning - Power Supply Borrowers
- 161-1 Interruption Reporting and Service Continuity Standards for Electric Distribution Systems
- 161-3 Inspection and Maintenance of Distribution Lines
- 161-4 Pole Inspection and Maintenance
- 161-8 Voltage and Current Investigations
- 161-11 Operation and Maintenance Records for Distribution Equipment
- 161-14 Maintenance of Oil Circuit Reclosers and Sectionalizers
- 161-17 Brush Control in Right-of-Way Maintenance
- 161-22 Application Guide for Transformers
- 161-23 Manual on Underground Corrosion Control in Rural Electric Systems
- 165-1 Substation Inspection and Maintenance
- 169-1 The Application of Shunt Capacitors to the Rural Electric System
- 169-4 Voltage Levels on Rural Distribution Systems
- 169-27 Voltage Regulator Application on Rural Distribution Systems

V. Procedures for the Review and Evaluation:

- A. The REA field engineer will consult with the borrower and arrange a scheduled time for the review and his evaluation.
- B. The borrower should conduct its review, including completion of Form 300, Rating Summary, (attached to this bulletin) prior to the field engineer's evaluation.
- C. The borrower should make available to the REA field engineer the completed Form 300 and records relating to operation and maintenance of the electric system, including the following:
 - 1. Service interruption reports and summaries of experience.
 - 2. Overhead and underground line inspection and maintenance records.

3. Substation inspection and maintenance records.
 4. Recloser and sectionalizer records.
 5. Line voltage regulator records.
 6. Distribution transformer records.
 7. Watthour meter records.
 8. Right-of-way maintenance records.
 9. Line voltage and current records.
 10. Up-to-date system maps.
 11. System losses.
 12. Idle services.
 13. Radio and television interference records of complaints and corrective actions.
- D. The REA field engineer may inspect facilities as well as records. He may also observe construction and maintenance work in the field. In these inspections he should be accompanied by key employees responsible for the facilities being inspected.
- E. If the REA field engineer finds that adequate information is available, he will complete his evaluation and consult with the borrower regarding its programs for operation, maintenance and system improvements. The field engineer will add his signature to the Form 300, signifying acceptance of the review (although he may not fully agree with the conclusions). The field engineer will furnish his comments and recommendations to the borrower.
- F. If, however, the information on hand is not adequate in the opinion of the REA field engineer for completing his evaluation, the evaluation should be deferred and the borrower requested to take actions as necessary to meet certain requirements. Illustrations of actions that the field engineer may request are as follows:
1. Conduct (or have conducted) with qualified personnel an inspection of _____ miles of distribution (and/or transmission) line, using the record form of REA Bulletin 161-3

or equivalent. (Line sections should be selected on the basis of age and location to reflect conditions typical of the entire system.)

2. Install an on-going line inspection and maintenance program in accordance with Bulletin 161-3.
3. Inspect all substations and record observations in accordance with Bulletin 165-1.
4. Inspect voltage regulators and/or reclosers and sectionalizers, and record observations.
5. Make determinations of system power factor and/or losses.
6. Set up specific types of systematic records to be used on a routine basis.
7. Complete the Form 300.

VI. Use of REA Form 300 for Ratings and Evaluations: Spaces are provided on Form 300 for the borrower to use in rating electric plant condition, records, operation, maintenance and plans. Numerical ratings should be entered for all applicable items. The ratings are on a scale as follows:

- 0 No records.
- 1 Corrective actions required.
- 2 Improvements may be desirable, but no action required at present.
- 3 Satisfactory, no action needed.
- NA Not applicable.

For ratings of 0, 1 or 2, give details under Explanatory Notes.

The discussion that follows refers to numbered items in Form 300, attached to this bulletin:

- 1, 3. Transmission and Distribution Substations Including Switching Stations: Records should be on hand from monthly and annual inspections as called for in REA Bulletin 165-1. All substations should have been inspected regularly and the results, including corrective actions, recorded.

Special visits to each substation may be desirable as a part of this review and evaluation.

- 2,4,5. Transmission and Distribution Lines Including Underground: Line inspection and maintenance log sheets should be on hand as a result of an on-going program in accordance with REA Bulletin 161-3.

For transmission lines, intervals between systematic inspection and/or patrols will vary according to capacity, importance of the line and hazards to which it is exposed. Annual inspections are suggested, with additional patrolling of radial transmission lines where an outage would interrupt service to one or more substations.

For distribution facilities, three years is suggested as the interval between systematic inspections and up-dating of the Line Inspection and Maintenance Log Sheets (Bulletin 161-3). Longer intervals may be satisfactory where inspection results are sufficiently favorable, particularly if the systematic inspections are supplemented with aerial surveys or other patrolling. If state or local regulations require inspections at specified intervals, records should confirm that the required inspections were made.

Line inspections for this review and evaluation are intended only to verify the effectiveness of on-going inspection and maintenance programs. In the absence of on-going programs and records, the evaluation should be deferred. See Paragraph V. F., page 3.

6. Distribution Line Equipment Condition and Records: Equipment records should give up-to-date information including locations, maintenance and description of each device.
- a. Voltage regulator records should include logs of operation counter readings and operating range since previous inspection. Is line drop compensation being employed for optimum results?
 - b. OCR and sectionalizer records should indicate inspection intervals, maintenance intervals and operation counter readings. Do numbers of operations indicate need for line maintenance or better coordination on any feeders?
 - c. Are watthour meters being tested on a clearly defined testing cycle?
7. Line Inspection and Work Order Procedures: Line inspection and work order procedures should provide a continuing picture of work backlogs for crew scheduling and evaluations of manpower requirements. (See suggestions for job order

and work order controls in Bulletin 161-3.) Backlogs of non-emergency work may be helpful for scheduling on an area basis to reduce costs. Is the workload manageable with the manpower and other resources available?

8. Service interruptions: Interruption reports and summaries, such as discussed in Bulletin 161-1, should be on hand. Service interruption data for the past five years should be entered in the space provided. A goal or target should be set for the maximum average interruption time regarded as acceptable. This goal might be two hours, three hours, or four hours per consumer. REA considers an average of five hours or more per consumer as unacceptable except under very unusual circumstances. When goals are not met, the reason should be known and corrective actions taken as necessary.

Interruptions may remain unreported and unknown to the power supplier for considerable lengths of time when the services are to intermittent loads such as summer cottages or pumps operated only in certain seasons. Also, service to an individual consumer may be interrupted at the request of the consumer during grading or blasting operations. Interruption data from such occurrence are not significant for evaluating system operation and may distort the data and should be excluded.

Other interruption data, in addition to average consumer hours, are considered to be important enough to deserve special attention:

- a. Interruption experience in parts of the service area and on individual feeders, in addition to system averages.
 - b. Numbers of interruptions, as well as total hours, on individual feeders as well as substation and system averages.
 - c. Momentary interruptions during switching or operation of automatic reclosing devices if the loads served are such that these interruptions could cause serious losses or damage to consumer-owned equipment.
9. Radio and Television Interference: Radio and television interference complaints should have been routinely noted and followed up for favorable consumer relations. Also, interference gives early warnings of conditions that may lead to component failures and service interruptions.

10. Loading and Load Balance: Distribution transformer load management should include systematic checking of metered demand or energy use against kVA transformer size.

Is load control and associated communication equipment, if used, being checked and maintained through the use of periodic and preventive maintenance schedules?

Periodic checks and adjustments of load balance between phases should be performed on three-phase lines to minimize voltage drop, loading of individual phases and line losses. Load balance checks should be performed under conditions of 75 to 100 percent peak load.

Substation and feeder loads and load trends should be recorded for operation purposes to anticipate loading which might lead to poor voltage or problems in picking up loads after line outages.

11. Maps and Plant Records: Maps and plant records should include, as a minimum, proper staking sheets for all current and recent construction and up-to-date detail maps, circuit diagrams and key maps for operating and engineering use.

REA encourages relatively simple records in preference to elaborate and costly maps or other records that may be difficult to maintain. Also, REA advises against detailed pole numbering. See Bulletin 40-4.

12. System Load Conditions and Losses: Data should be evaluated separately for each substation or metering point. Variations and trends, month-by-month or year-by-year, are often significant. Are these data significant with regard to voltage levels, possible energy diversion (theft), need for power factor improvement and load management? Are specific actions needed?

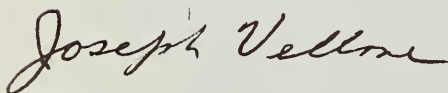
13. Voltage Conditions: Identify records and activities necessary for good operation and planning. Is the needed information available?

14. Load Studies and Planning: The long range plan and work plan should be up to date and supported by adequate data for developing work plans and budgets for the distribution borrower (Bulletin 105-1) and for the power supplier (Bulletin 105-7). Are load data adequate for effective planning and valid projections of future power requirements?

15. Job Training and Safety Program: Responsibility should be specifically assigned and time allowed for needed training. Are statewide or other local resources being utilized?

16. Budgeting: Budgets should be in terms of manpower or work units as well as dollars to assure that resources are available to perform the work that is proposed. This is particularly important in planning to clear a backlog of high priority deferred maintenance items. Bulletin 105-1 describes a budgeting system to insure that manhour and dollar resources are used as effectively as possible. The budget should also provide a means for evaluating progress as the budget period wears on. A well prepared budget should help answer questions such as:
 - a. Can needed work be done with existing staff or through workable contracting arrangements?
 - b. Can timely work plan improvements relieve future maintenance costs?
17. The board of directors should be apprised of findings from the review, particularly if there may be changes indicated in budgets or operating and maintenance practices. When appropriate, a board resolution should be adopted confirming actions to be taken.

Explanatory notes should include a list of all items rated as requiring attention (ratings 0 or 1) along with comments indicating the action or implementation that is proposed. Additional manhours and dollar expenditures required for deferred maintenance should be indicated in the Operation and Maintenance Budgets, Part V of Form 300. These may be distributed over a period of two or three years as shown on the form.



ACTING
Administrator

Attachment:

REA Form 300 - Review Rating Summary

Index:

DISTRIBUTION FACILITIES:

System Review and Evaluation

OPERATION AND MAINTENANCE:

Review and Evaluation

"No further funds may be advanced under this program unless this report is completed and filed as required (7 USC 901 et seq.)"

USDA — REA Form Approved OMB No. 040-R2350		BORROWER DESIGNATION DATE PREPARED																																										
REVIEW RATING SUMMARY																																												
Ratings on form are: 0: No records 1: Corrective Actions Are needed 2: No action required, but might be improved 3: Satisfactory NA: Not applicable																																												
PART I. TRANSMISSION																																												
1. Transmission Substations (Rating) _____ a. Safety, Clearance, Code Compliance _____ b. Physical Condition: Structure, Major Equipment, Appearance _____ c. Inspection Records Each Substation (Bulletin 165-1) _____	2. Transmission Lines (Rating) _____ a. Right-of-way : Clearing, Erosion, Appearance, Intrusions _____ b. Physical Condition: Structures, Conductor, Guying _____ c. Inspection Program and Records _____																																											
PART II. DISTRIBUTION FACILITIES																																												
3. Distribution Substations (Rating) _____ a. Safety, Clearance, Code Compliance _____ b. Physical Condition: Structure, Major Equipment, Appearance _____ c. Inspection Records (Bulletin 165-1) _____ 4. Distribution Lines - Overhead a. Inspection and Maintenance: Program and Records (Bulletin 161-3) _____ b. Compliance with Safety Codes: Clearances _____ Foreign Structures _____ Attachments _____ c. Observed Physical Condition from Field Checking Right-of-way _____ Other _____	5. Distribution - Underground Cable (Rating) _____ a. Grounding and Corrosion Control (Bulletin 161-23) _____ b. Surface Grading, Appearance _____ c. Riser Pole: Hazards, Guying, Condition _____ 6. Distribution Line Equipment: Conditions and Records a. Voltage Regulators (Bulletin 169-27) _____ b. Sectionalizing Equipment (Bulletin 161-11) _____ c. Distribution Transformers (Bulletin 161-11) _____ d. Pad Mounted Equipment Safety: Locking, Dead Front, Barriers _____ Appearance: Settlement, Condition _____ Other _____ e. Watthour Meter Reading and Testing _____																																											
PART III. OPERATION AND MAINTENANCE																																												
7. Line Maintenance and Work Order Procedures (Rating) _____ a. Work Planning and Scheduling _____ b. Work Backlogs: Right-of-way Maintenance _____ Pole Replacements _____ Idle Services - Retirement of _____ Other _____ 8. Service Interruptions (Average Annual Hours/Consumer by Cause)	9. Radio and Television Interference (Rating) _____ a. General Freedom from Complaints _____ b. Effective Handling of Problems that Arise _____ 10. Loading and Load Balance a. Distribution Transformer Loading _____ (Optional) Ratio: Distribution Transformer kVA to Substation Peak kW _____ b. Load Control Apparatus _____ c. Substation and Feeder Loading _____ d. Each Phase Current within 20% of Peak Average of Three Phases, during Heavy Load Periods _____ 11. Maps and Plant Records (Bulletin 40-4) a. Operating Maps: Accurate and Up-to-Date _____ b. Key Maps _____ c. Circuit Diagrams _____ d. Staking Sheets _____																																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">PREVIOUS 5 YEARS</th> <th style="width: 10%;">POWER SUPPLIER a.</th> <th style="width: 10%;">MAJOR STORM b.</th> <th style="width: 10%;">SCHE'D c.</th> <th style="width: 10%;">ALL OTHER d.</th> <th style="width: 10%;">TOTAL e.</th> <th style="width: 10%;">RATING</th> </tr> </thead> <tbody> <tr><td>19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>			PREVIOUS 5 YEARS	POWER SUPPLIER a.	MAJOR STORM b.	SCHE'D c.	ALL OTHER d.	TOTAL e.	RATING	19							19							19							19							19						
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PART IV. ENGINEERING																																												
12. System Load Conditions and Losses (Rating) _____ a. Annual System Losses, _____ % _____ b. Annual Load Factor, _____ % _____ c. Power Factor at Monthly Peak, _____ % _____ d. Ratios of Individual Substation Annual Peak kW to kVA Capacity below those of Bulletin 161-22 Table II _____ 13. Voltage Conditions a. Voltage Surveys (Bulletin 161-8) _____ b. Percent of Consumers with Service Voltage not in Range A (Bulletin 169-4) 0 - 3%, 3 - 10%, over 10% _____ c. Substation Transformer Output Voltage Spread (Bulletin 161-4) Settings Checked _____	14. Load Studies and Planning (Rating) _____ a. Long Range Plan _____ b. Work Plan _____ c. Sectionalizing Study _____ d. Load Data for Engineering Studies _____ e. Power Requirements Data _____ 15. Safety and Job Training a. Responsibility for Safety Program (Bulletin 168-7) is assigned to a qualified individual _____ b. Adequate Attention to Worker Training and Competence _____																																											

PART V. OPERATION AND MAINTENANCE BUDGETS										
Year	Previous		Present		Future					
	19	19	19		19		19		19	
	Actual \$ Thous.	Actual \$ Thous.	Budget \$ Thous.	Manhours	Budget \$ Thous.	Manhours	Budget \$ Thous.	Manhours	Budget \$ Thous.	Manhours
Normal Operation										
Normal Maintenance										
Additional (Deferred) Maintenance										
Total										

16. Budgeting (Rating)

a. Needed Work Can Be Done With Present Staff or Contracted

b. Adequacy of Budgets For Needed Work

17. Discussed With Board of Directors (Check) Yes ☐ No ☐

Remarks:

EXPLANATORY NOTES

ITEM NO.	COMMENTS

RATED BY: _____, Manager _____ Date _____

REVIEWED BY: _____, REA Field Engineer _____ Date _____

